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Collaborative Learning to Boost Digital Signal Processing Grades

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ABSTRACT

A course in digital signal processing (DSP) is mandatory for all Electrical Engineering majors at Universitas Andalas. In this course, students will learn the basics of digital signal processing and how to put that knowledge to use in real-world scenarios. Since the course materials were presented in a teacher-centered manner, the course learning outcome (CLO) was not sufficiently satisfied. Digital signal processing (DSP) classes might benefit from a collaborative learning strategy, which is the main topic of this article. Finding out whether the method helps with DSP mastery is the primary motivation for the research. The study is being conducted in the Digital Signal Processing (DSP) class at Mandalas University's Electrical Engineering Department. We get this data via a variety of channels, such as, but not limited to, assessments, projects, homework, and self-evaluation. To arrive at a decision, the proposed idea is compared to the aim set forth in the semester's learning plan. The descriptive form is used to report the study's results.

Keywords:

Indicators of success in the classroom, Collective teaching, Alternatives to Traditional Classroom Structures that Put Students.

INTRODUCTION

Students majoring in electrical engineering at Universitas Mandalas must complete a digital signal processing (DSP) course (Unhand). The last semester of the school year is spring, when this class meets. All students in the department are required to finish the prerequisite course, Signal and System, before starting the DSP course [1]. An objective-based high school curriculum (K-PT) has been in place for Electrical Engineering at Unhand since 2016. In order to create the learning outcomes (IABEE), the Indonesian National Qualification Framework and the Indonesian National Higher Education Standards (SNPT) were consulted. A solid understanding of the engineering sciences, engineering principles, and engineering design essential to the analysis and design of electrical power systems, communications systems, and control systems is one of many student learning outcomes (SLOs) utilized by the Department of Electrical Engineering to direct instruction and evaluation of students. (2) Skilled in addressing problems within one's area of competence by using the results of data and information studies to make reasonable conclusions. Thirdly, they can solve complex problems in the areas of electrical power, communications, and control systems by using mathematical, scientific, and technological approaches [1-2].

Digital signal processing course requirements inspired the development of these SLOs. The ability to go back and forth between analogue and digital systems is one of the DSP CLOs. As far as z-domain analysis of digital systems is concerned, student (2) is competent. Thirdly, the candidate must demonstrate proficiency in using discrete-systems mathematics in practical contexts. (4) It is possible for a student to construct a frequency domain filter that functions as expected. Due to its mandatory nature, DSP attracts an average of 130 students each semester. Learning the CLO was challenging since the course used a traditional method of instruction. In traditional classroom settings (TCL), the focus is on the instructor as the main participant in what is supposedly "teacher-centred" learning. Negative aspects of this method include the promotion of class passivity and the resulting rise in the number of students who do poorly academically. Contrary to expectations, the CLOs are losing value. The results of the DSP class over the last two years back this up.

Students' academic performance is positively impacted by studying in a group environment, according to studies. Collaborating in groups has many academic benefits, including improved

information transfer [5, 6] and enhanced student performance in the classroom [3, 4]. Studying in groups helps develop important social skills including public speaking, problem solving, taking the lead, distributing tasks, and organizing knowledge [6]. Based on these findings, we propose enhancing the DSP course's next academic year (AY 2020/21) by including a cooperative learning strategy to help students create better CLOs. As a result, the average grade in the class went up.

METHODS

All three DSP classes of Mandalas University's electrical engineering department are taking part in the research.

Roughly one hundred thirty-three people have registered for this course. Pupils have already begun to organize into groups. Using the student list given by the learning management system, the group's composition is determined, including the mix and diversity of its participants. Instead than allowing pupils to create their own groups, teachers always assign them at random. This helps to avoid cliques. Because there are so few female students overall, (b) every group must include a female student. c) There are exactly the same number of students from the same cohort in each class group. The result is that there are nine or ten groups, with four or five students in each. This data is gathered using a variety of assessment tools, such as class participation, homework, assignments, midterms, and final examinations, which gauge students' understanding of the course content. Additionally, self-evaluation is used to enhance the data even further. To carry out the analysis, we need to know what percentage of students get a score greater than the target. A minimum score of 55 on each CLO is required of all students. 55 is the same as a "C" according to the Academic Regulation of Andalas University. Each CLO should have a passing grade of at least 55%. The outcome of the final assessment is reflected in the indicator. Next, the detailed description of the analytical findings follows.

HOW WE DISCUSSED AND WHAT WE FOUND

Data gathered from students' self-evaluations, homework, and projects may provide a picture of their "soft skills," which include things like their capacity for teamwork, communication, and initiative. All three of these "softer skills" are shown in Figures 1, 2, and 3.

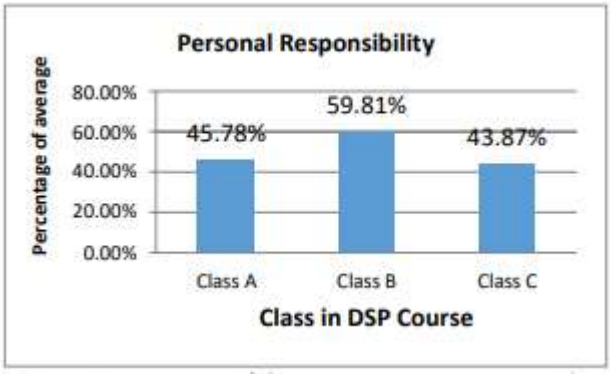

Figure 1 Percentage of the average score on personal responsibility in a group.

Figure 1 shows that students in class C have the lowest average score, which is 43.87% on personal responsibility in the group. Class B is the top scorer and the second by Class A with the average score of 59.81% and 45.78% respectively.

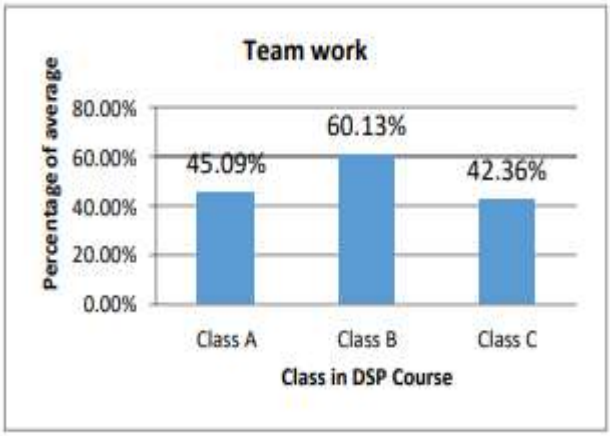

Figure 2 Percentage of the average score on teamwork in a group.

Students in Class B have the highest average score which is 60.13% on teamwork. At the same time, Class A and Class C are the second and the last with the average score of 45.09% and 42.36% respectively.

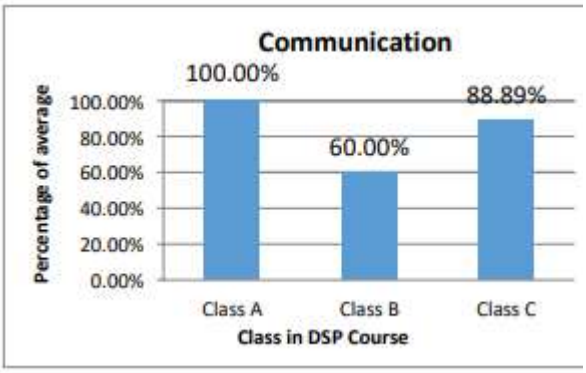

Figure 3 Percentage of the average score on communication in a group.

The average score on communication ability was the lowest among students in Class B (figure 3). The average score of students in Class A is 100%, while that of students in Class C is the lowest at 88.89%. All four assessments—the midterm, the final exam, the assignment, and the final project—evaluate and assess students' development towards CLOs. The Assignment assessed the student's performance in CLO 1, whereas the Final Project assessed their success in CLO 2. The Midterm and Final exams are used to gauge the students' progress towards CLO 3 and CLO 4. The results of the CLO examination are summarized in Figure 4. Following the DSP course's semester-long learning plan, the results are presented as a percentage.

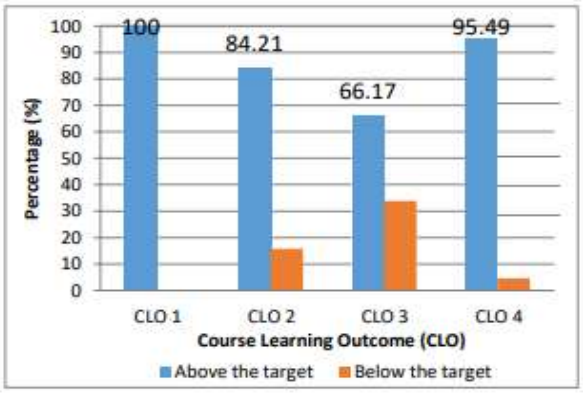

Figure 4 Percentage of achievement on different CLOs.

The assessment percentage for CLO 1 is the highest at 100% when compared to other exams. Following this CLO 1, CLO 4 demonstrates the student's capacity to design a filter that meets frequency-domain specifications. Ninety-five point four percent of the whole debt is CLO 2. At 84.21%, CLO 2 is in fourth position, while at 66.17%, CLO 3 is in fifth place. Typically, the target is exceeded by each CLO %. Every CLO aims for 55%. Importantly, a score of 66.17% is required. The cumulative assessment scores of each student for the 2019-2020 academic year will be used to calculate their final grade. The transformation from letter grades to scores is seen in Figure 5.

Students' improved performance in the course so far will be reflected in their grade for the 2019–2020 academic year. By a margin of at least 66.17%, every CLO has surpassed its limit. The fact that a higher percentage of students were able to pass the class this time around supports this finding.

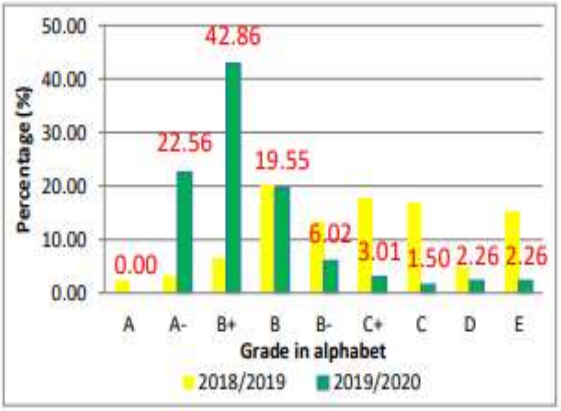

Figure 5 The comparison of the grade distribution between two academic years in the DSP course

The percentage of students who received an A or B+ in the 2019–2020 academic year also increased. The overall growth rate was 55.74 percent higher than the prior year. The A-grade follows the same general principle.

CONCLUSION

This study's findings suggest that digital signal processing courses that include cooperative learning strategies greatly improve their educational value. By a margin of at least 66.17%, every CLO has surpassed its limit. The fact that a higher percentage of students were able to pass the class this time around supports this finding.

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